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How can we explain the emergence and stability of academic career patterns?[1]

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Introduction

Academic careers emerge because researchers make choices. They decide to apply for certain positions, to accept a job offer or, if they are committee members, to accept a particular applicant. These selection processes do not lead to individual careers that are completely idiosyncratic. We observe recurring career patterns of similarly shaped individual sequences of work experiences in specific contexts. These macro-level patterns cannot be explained solely by referring to societal institutions because the latter do not provide sufficient information to guide career decisions, and because different field-specific career patterns emerge in the same national institutions.

The aim of our paper is to explain the emergence and stability of career patterns as macro-level effects of a multitude of individual decisions. We utilize an idea of Barley (1989), who introduced career scripts as collectively shared interpretive schemes that mediate between institutions and individual actions. The concept has been applied to academic careers (e.g. Duberley et al. 2006, Valette and Culié 2015) but has remained ambiguous and difficult to operationalise, which is why it has been mostly used as a descriptive label for empirically observed career phenomena. We operationalise the concept and demonstrate that scripts are important causal macro-level factors which, by shaping individual decisions, create field-specific macro-level career patterns.

Theoretical concepts

We define career scripts as collective interpretive schemes that encode sequences of stages within a career and decisions that are likely to produce these sequences. They represent steps of commonly successful careers in a specific institutional setting. Since scripts are collectively shared by all researchers in this institutional setting, they are a macro-level phenomenon.

An actor usually knows one or more career scripts that are relevant to their specific institutional environment. When making career decisions in particular situations, actors position themselves in these scripts and decide about the next career move from the perspective of a sequence of moves leading to career progress (Figure 1). Thus, career decisions enact scripts and thereby

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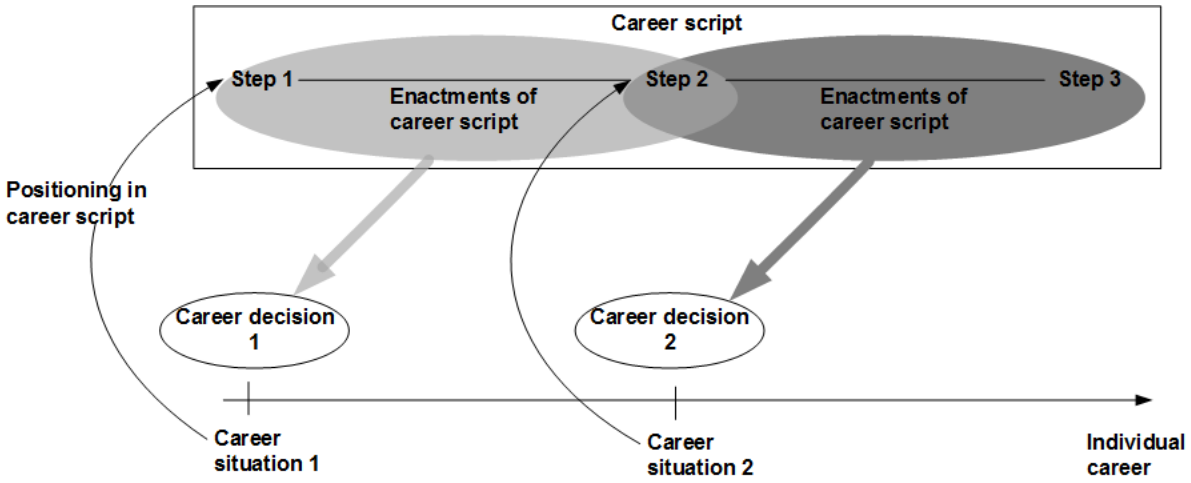
maintain them. Deviant decisions may alter scripts over time (Barley 1989, Barley and Tolbert 1997).

Figure 1: Enactment of scripts in career decisions (Laudel et al. 2018).



In the case of academic careers, several scripts co-exist because researchers have simultaneous careers in different contexts. We distinguish three interrelated careers of a researcher, namely the cognitive career, the community career and the organizational career (Laudel and Gläser 2008; Gläser and Laudel 2015b).

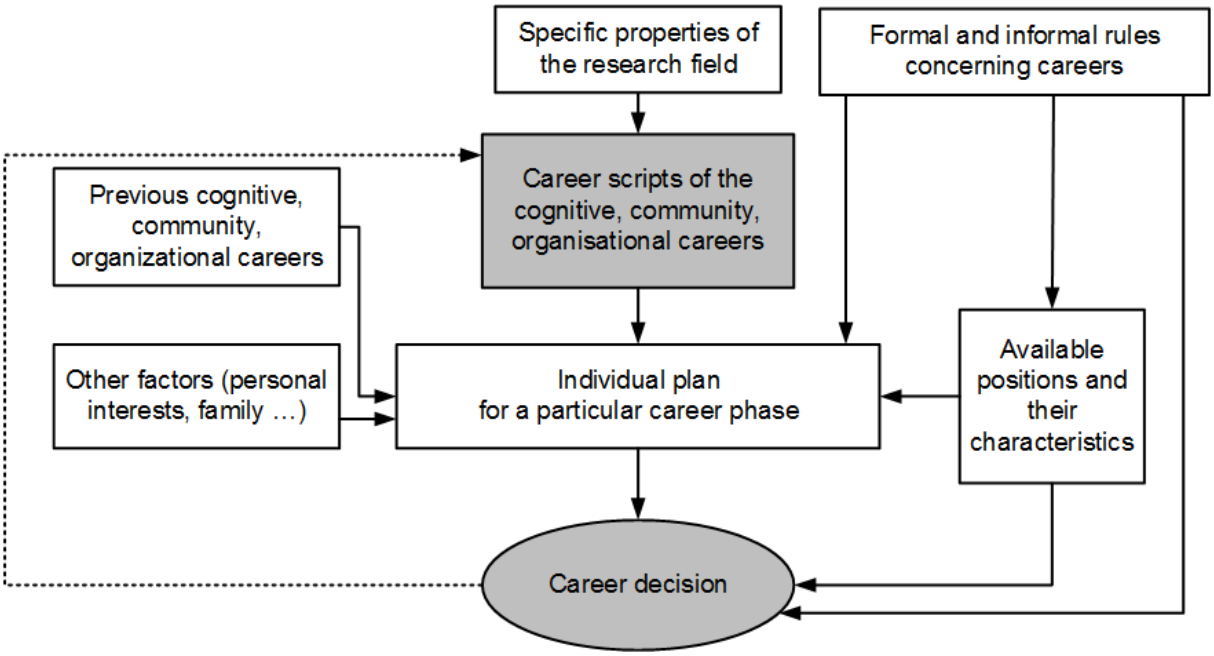
(1) The *cognitive career* consists of thematically connected problem solving processes in which findings from earlier projects serve as input in later projects. These connected problem solving processes constitute one or several distinct 'research trails' (Chubin and Connolly 1982). They form a diachronic structure that gradually extends a researcher's knowledge base. The evolution of the content of research has distinct stages and structures, and is closely linked to other career experiences. The *script of the cognitive career* is an interpretive scheme that reflects the originality, relevance, durability and (often increasing) thematic breadth of research.

(2) The *community career* is a series of status positions in the scientific community that are defined by the reputation a researcher has accrued and corresponding role expectations. This includes the status of an apprentice, a colleague, a master and member of the elite. The *community script* is an interpretive scheme that reflects the continuous gaining of reputation and the sequence of statuses within the scientific community.

(3) The *organisational career* is a sequence of organisational positions which, through organisational role expectations, are linked to expectations concerning the conduct and content of research and provide opportunities to conduct research (access to salary, infrastructure, and other resources). The *script of an organizational career* is an interpretive scheme that reflects sequences of organizational positions that are typically successful in achieving specific career goals.

Our framework for the analysis of career decisions includes the researcher's career plan for their next career phase and the perception of available positions as immediate influences on career decisions (Figure 2). We assumed the individual plans to be influenced by the perception of available positions, of rules concerning careers, the researcher's three careers up to the time of the decision, other factors like personal interests or family concerns, and scripts for the three careers. The scripts were likely to be field-specific. In extended time frames, individual career decisions will not only be an enactment of scripts but may also change them if actors respond to changed conditions by making different decisions (Barley 1989, p.54) which is depicted by the arrow with the dotted line.

Figure 2: Model of the enactment of career scripts in academic career decisions.



Methods

The analysis of career decisions presented here is based on comparative case studies of 31 German early career researchers from experimental Atomic and Molecular Optics (AMO) physics[2]. We compared the early career phases of researchers who obtained their PhD between two and nine years prior to the time of the interview. Most of these researchers held non-tenured positions as postdocs, university assistants, junior group leaders or junior professors.

The case studies are based on semi-structured interviews, which consisted of two main parts. In the first part, the interviewee's research and cognitive career were discussed using network representations of the interviewee's research biography (Gläser and Laudel 2015a). We explored the development of the interviewee's research since the PhD project with a focus on thematic changes and their reasons. The second part of the interview focused transitions in the organisational career. We asked about the decisions to take a new position, the respective reasons and potential alternatives, and opportunities as well as constraints provided by the interviewee's organizational position.

The analysis of the interviews built on a qualitative content analysis that extracted relevant information from the interview transcripts by assigning it to categories that were derived from our theoretical framework.

The identification of scripts and their role in career decisions was based on a comparative analysis of decisions. We identified all decisions reported by our interviewees. From the descriptions of these decisions, we extracted information about the decisions' outcomes, possible alternatives considered by interviewees, and reported reasons for selecting one particular option. Reasons were categorised as individual plans, references to scripts, perception of available positions, preceding career phases, institutional rules, personal interests, family concerns, and other factors. For the cognitive career script we searched for reasons that referred to an internal logic of progress in individual plans for knowledge production. The community career script was derived from references to the accumulation of reputation (particularly through publications) and career expectations ascribed to the scientific community as social

[2] The overall study contained two more research fields which have been excluded here due to space restrictions.

context. For the organizational career scripts, we searched for patterns in descriptions of properties of organisational positions sought by and offered to researchers.

Findings

Research in experimental AMO physics is aimed at answering theoretical questions by manipulating and measuring the behaviour of micro objects (from molecules to elementary particles). They are derived from theory and experiments that are designed specifically to answer these questions. Building the needed complex experimental setting usually takes several years.

A central concern of the early career phase of AMO physicists is the development of their first individual research programme (IRP). An IRP in experimental AMO physics is a longer-term research endeavour that is based on such a purpose-built experimental system and aims at answering a set of theoretical questions. The plan consists of a design for such a system and the theoretical idea. It is a combination of theoretical considerations with knowledge of experimental possibilities. Searching for an IRP means learning to master different techniques and finding the theoretical idea. To find the theoretical idea one has to closely follow theoretical discussions in the community and interpret them in the light of one's own experimental experiences. Epistemic competition exists in experimental AMO physics but can be avoided by modifying an experimental setup so it can answer different questions.

The *cognitive career script* of the early carer phase includes monitoring the theoretical discussions of the field and using experimental settings of one's host group for tests of the methodological implications of theoretical ideas. It consists of interrelated steps of learning, acquiring theoretical knowledge and experimental testing of ideas. The script includes a close observation of other groups and differentiation of the IRP in order to enable original contributions.

The *community script* for the phase in which IRPs are searched is one of gaining sufficient reputation for obtaining positions and grants that enable the search and subsequent realisation of the IRP. For early career researchers from AMO physics this translates into producing publications in prestigious journals on each position, because otherwise the next position would be difficult to obtain. The publication record is also important for obtaining a group leader position and for acquiring additional grants, which is necessary for realising an IRP. In the following example, the risk of not being able to publish during the postdoctoral stay affected the career decision (the underlined statements in all following quotes identify phrases from which we derived scripts as collectively shared knowledge about successful careers):

> And this was important to me, too. I knew that a postdoc means going somewhere for two or possibly three years, and that one has to publish during that time, to have something to show. And accomplishing something during that time in Zurich seemed unlikely. And here it is more likely that it works.

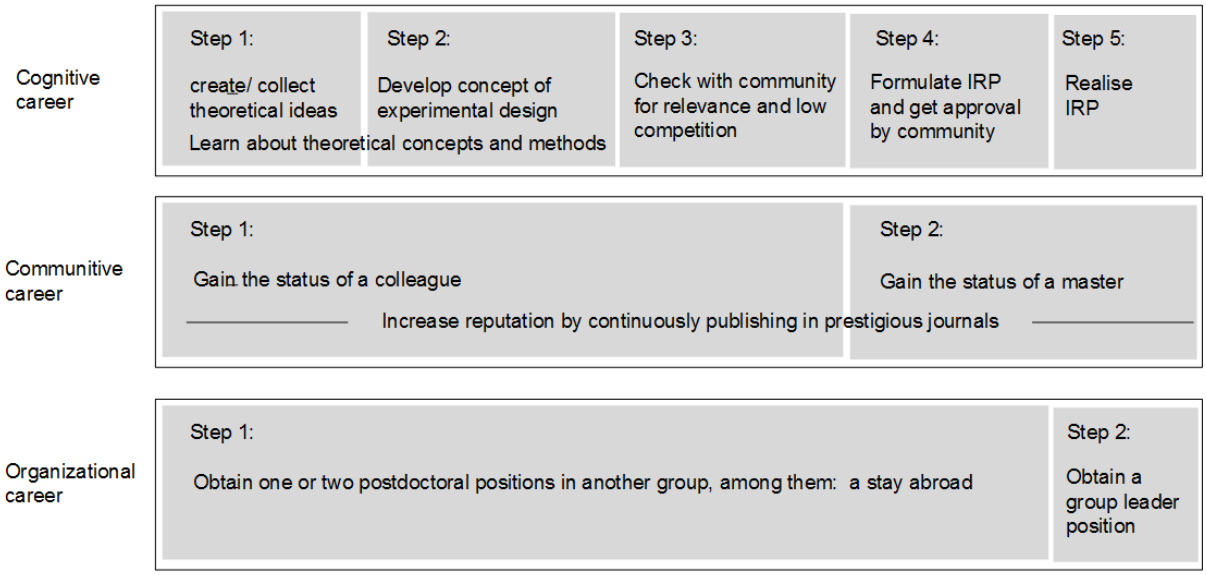
The *script of the organizational career* reflects a sequence of organisational positions that is necessary to develop and realise an IRP. In AMO physics, the cognitive script of broadening one's knowledge base and searching for an IRP are reflected in a diffuse script of taking up one or two postdoctoral positions and then move to the position of a group leader on which the first IRP can be realised before finally obtaining a tenured position. The script entails organizational mobility in the postdoctoral phase, which includes international mobility. The script has been enacted by funding agencies who inscribed organizational career moves into eligibility rules for junior group leader positions.

> And after the PhD the question arises what to do. It is common to go abroad to a different group and to do a postdoc.

Figure 3 summarizes the three scripts and their alignment. The three careers interact and maintain each other in each of the steps. In the first phase, the postdoctoral positions must

support the development of an IRP, i.e. enable the learning. At the same time, they must yield enough publications to ensure success with the next application. When the researchers designed an IRP, the community must approve it, which entails the ascription of master status and the selection for the organisational position of a group leader.

Figure 3: Career scripts in experimental AMO physics.



Having identified the three career scripts and having illustrated how they operate in career decisions, we now turn to the extent to which scripts were enacted by our interviewees. Table 2 provides an overview of our cases.

Table 1. Patterns of script enactment in AMO physics.

Number of cases	cognitive career script	community career script	organisational career script
20	Conform	Conform	Conform
6	Conform or fast track	Fast track	Fast track
5	Non-conform	Conform (publishing)	Non-conform

In the majority of cases (20), career decisions, career progress and personal plans of interviewees conformed to the three career scripts, and their movements through the three careers were aligned as shown in Figure 3. We observed two interesting deviations from that pattern. A first deviation can be characterised as fast track. It includes researchers who knew about the career scripts but didn't enact them the same way the majority did. These six interviewees developed their IRP during their PhD or soon after and gained their master status and the position of a group leader without going through all the steps of the organisational career script. They skipped the postdoctoral phase entirely by becoming group leaders immediately after their PhD or skipped the international mobility by becoming a group leader before they undertook this move. In all these cases they responded to opportunities, i.e. to a situation where the elite of their field made positions available at an earlier stage of their organisational career because they were well advanced in their cognitive and community careers.

In order to establish a causal role of career scripts beyond the simple correspondence, we need to demonstrate that researchers enacted the scripts in their career decisions. We provide three more examples of researchers describing career decisions with reference to career scripts.

> There I reoriented slightly. This is actually quite typical to try something new after the PhD thesis, just to learn something different, learn other methods, go abroad.

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> I wanted to go to [this US city] whenever possible. But then I also said I deliberately want a certain change of topic because I did already the Diploma thesis and the PhD thesis on the same topic. It was not a giant leap, it is still atom physics, optics, it was still similar, but it was a certain thematic leap.

When selecting a postdoctoral position, both physicists chose one that conformed to the cognitive script (learning, thematic change) and to the organizational script (go abroad).

> However, the question arises for me whether I stay here any longer [as a postdoc][…]. Or if it would be better to do something new. That's what I am contemplating at the moment. You have to run a bit on sight, always having the next two or three years in mind. If I had something where I knew that I could achieve a fantastic result in one or two years, then I would be more prone to stay here. Otherwise, if this will be a lengthy dry spell then I have to consider, from the point of view of CV, the later career, if that still benefits me.

When contemplating whether to extend his postdoctoral stay, this researcher enacted the community script (continuously publishing).

Five researchers did not conform to the scripts of a continuing academic career. Two researchers refused to do so because some of the steps did not match their personal interests. They preferred a continuation of their current dependent research to developing an IRP, becoming an independent researcher and becoming a group leader. They were diffusely aware of the necessity to leave academia but did not enact an exit script. Three more researchers explicitly planned to leave academia rather than enacting the three academic career scripts. Instead of developing an IRP, these researchers just conducted dependent research and published. One researcher acquired additional knowledge that would prepare him for his later non-academic career.

Discussion

Our empirical investigation of early career researchers' career decisions obtained information about scripts in three different ways. First, some descriptions of decisions included descriptions of scripts that matched the definition. Interviewees referred to 'the way in which things are done' if one wants to have a successful career. Second, scripts were described as expectations of the community. Typical phrases in interviews included 'it is expected' or 'it is common'. Since no actor was specified in these descriptions, we considered them as representations of scripts.

The third and most important indication of the operation of scripts were many decisions reported by interviewees that simply conformed to the scripts. No interviewee reported looking for a professorial or group leader position without having an IRP. None of the AMO physicists applied for a group leader position immediately after their PhD without being asked to do so (in the 'fast track' cases). In other words: The many career decisions the researchers could have made but didn't are the clearest indicator of their awareness of scripts.

Thus, early career researchers do indeed enact scripts when they make decisions about their careers. More precisely, they enact certain parts of scripts that are relevant to their career stage but do so in the light of the whole script. This makes scripts one of the causal factors influencing career decisions. Other factors like the availability of organisational positions and their

characteristics (in terms of autonomy, resources and time for research), and considerations beyond academia such as preferences for countries or languages as well as other interests and family concerns also affect career decisions and may override scripts.
Scripts are enacted not only by researchers when they decide about their careers. Members of the scientific community and funding agencies reinforce scripts through their criteria when they make decisions about positions, recruitment, and research funding. The very same actors may also change scripts and thus career patterns when they collectively change their actions that are directed towards careers.

Conclusions
In the case of academic careers, the production of macro-level effects by macro-level causes is always mediated by individual-level career decisions. We demonstrated a particular process of macro-macro causality, namely macro-level collective interpretive schemes influencing individual decisions on careers in a way that the careers form macro-level field-specific patterns. We suggest three conclusions from this observation. First, the causal relationship implies that researchers applying for positions and grants in their organisational career utilise these as resources for the enactment of scripts of the cognitive and community careers. Second, since the scripts are field-specific but most national institutions and organisational positions are not, the match between institutional and organisational structures, on the one hand, and career scripts, on the other hand, varies between fields. Consequently, some scientific communities have to work harder than others to make the governance structure of their country 'work' for their careers. Third, it is difficult to change academic careers through innovations in labour laws and funding structures because any changes will be utilized to enact existing scripts, which will dampen intended effects.

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